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quently theoretically supported to a certain extent by the theory of the continuity of the germ plasm."[5] It is far from the purpose of the reviewer to defend the system of Weissmann, in either its earlier or its later form, but fairness as well as historical accuracy demands this correction.

The second of Berthelot's twin hypotheses rejects 'the belief of Cuvier in providential intervention, in a creative action of the Divinity,' while preserving 'the idea that the origin of species has occurred in the greater number of cases, at least with higher species, in a sudden and collective manner, since it appears difficult otherwise to explain the paleontological facts in which Cuvier found support, and which are not less true to-day than they were eighty years ago.'

We are not told how great a modification Berthelot thinks may be fairly attributed to a single act of mutation; and we are left to wonder whether he would regard any of the larger gaps in the paleontological record as due to the non-occurrence of transitional forms, past or present. Some of the references to geology and to Cuvier would seem to imply this.

Finally, by a supreme act of synthesis, the author proposes to combine the two hypotheses just developed. By this means, 'we should obtain a view of the ensemble of biological evolution which would be neither that of Darwin nor that of Lamarck, since we should abandon the postulate of continuity, which is common to both of them, and since we should attribute the origin of new species neither to selection nor to the inheritance of acquired variations, whatever may be the influence of these two factors to call forth diverse changes, but of less amplitude, among living beings.'

To the reviewer these hypotheses of Berthelot's appear to be logical, rather than biological, creations. One looks through the paper in vain for new facts, and, indeed, for any really original interpretations. This is far from saying, however, that it is entirely lacking in interest or in suggestiveness.

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Les mathématiques et la logique. H. POINCARÉ. *Revue de métaphysique et de morale,* November, 1905. Pp. 815–835.

Sur la relation des mathématiques à la logistique, avec une note de M. Whitehead. B. RUSSELL. *Revue de métaphysique et de morale,* November, 1905. Pp. 906–917.

M. Poincaré, discussing M. Couturat's denial of any appeal to intuition in mathematics,[1] puts the issue with French clearness. Admit that from beginning to end the deductions of mathematics are interrupted by no intuitions: what is the source and meaning of the starting-points, yes, of the whole process? Whenever a new starting-point, a new 'arbitrary convention,' is adopted, why is *it* preferred to others? These conventions would need an accompanying axiom asserting their existence.

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[5] *Op. cit.*, p. 437

[1] *Revue de métaphysique et de morale,* 1905, *seriatim.*

This existence, of course, is not psychological nor physical, but logical; *i. e.,* such that the conventions may be so stated that no contradictions issue from them or any of their consequences (which consequences are in mathematics infinitely numerous). Now until you have proved the validity of complete induction, you can not argue with respect to an infinite series. But to prove complete induction you must show that none of an infinity of cases would offer in itself a contradiction. This you can not do without complete induction as a basis. Thus mathematics has no means of proving the logical existence of its concepts, except by an appeal to the intuition. Again, what guarantee have we that our definitions apply to the entity defined, *e. g.,* that the definition of number applies to those entities we call numbers? Surely it needs an intuition to perceive the identity of the two. Again, the definitions of pasigraphy do but give over again what we intuit directly, *e. g.,* the definition of one as the class of two members which are identical—for what is *two* unless we first know *one?*

Mr. Russell's indemonstrable axioms, not being shown by him to be incapable of self-contradiction, are again intuitions. M. Couturat indeed admits that we need a special axiom in each case to assert their existence. This amounts to admitting that we intuit them. We think M. Poincaré might say that even the deductions themselves have force to us because we intuitively perceive their value. Who can prove that proof is binding? Is it not an immediately felt certainty? In short, as, if I remember correctly, Professor Royce once remarked, intuition there is in plenty in mathematics, but the real issue is, is it the *kind* of intuition we have in space-perception and daily experience with the outer world? We do not see that M. Poincaré has here raised a point which Mr. Russell need deny. What the former calls an intuition the latter calls an indemonstrable proposition. But so long as M. Poincaré and (as quoted in the paper named above) M. Boutroux define intuition in a purely logical sense, not in an experiential sense, we do not see that there is an important difference between the two schools, and we must class both over against the school of radical empiricism which believes that existence, concept, truth, proposition, can be defined in psychological or physical terms. This question, we regret to say, the devotees of logistic do not explicitly examine. It is a fault common to the whole school, that they start from certain philosophic presuppositions which admit of much controversy, and then think that their methods and results must have fundamental philosophic value. The same criticism, we think, pertains to Mr. Russell's reply to M. P. Boutroux. Mr. Russell shows that correspondence is not an ultimate indefinable, that there is no gap in the reasoning which leads to it, needing to be filled by an appeal to intuition. And yet M. Boutroux, who defines intuition as 'not the result of sense-experience, nor of combination of or deduction from anterior knowledge'[2] could reply, we think, in the spirit of M. Poincaré, that it is a guiding force which leads us to combine or deduce from anterior knowledge, or even to set up new indefinables. We agree with Mr. Russell in finding this definition hard to understand, for we do not see that there is anything in it which could not be expressed in logistic terms. Indeed, Mr. Russell admits that if by intuition you mean the discovery of a new indefinable, you are consistent enough. M. Boutroux also accuses Mr. Russell of not getting all the detailed results of mathematics. The latter replies (justly, we think) that when you have defined a class like number intensionally, you have essentially deduced all the particular numbers: the general rule being given, that is enough. He accuses M. Boutroux in turn of confusing intension with extension. If the extension is not completely deduced, the intension may be: the latter alone is the subject-matter of mathematics. Again, M. Boutroux is said to confuse the act of discovery with the thing discovered. The thing discovered may be an object of intuition even while it is discovered by means of logistic processes. Of course; but is intuition after all essentially different from logistic proof? It seems unimportant, how we are led to discover a truth; the important question is, do the truths discovered, when reduced to lowest terms, show mutual independence, or are they logically dependent upon a small number of concepts and axioms? It is this connectedness or disconnectedness that we want to discover, and if logistic has shown that the complex 'subject-matter of exact thought' stands upon a very few simple truths, it has done a great thing. The real problems for discussion are, we think, not the issue between logical intuition and logical deduction, but the philosophical presuppositions of logistic, and the correctness of the definitions and deductions it contains.

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[2] *Revue de métaphysique et de morale,* XIII., p. 624.

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ZEITSCHRIFT FÜR PSYCHOLOGIE UND PHYSIOLOGIE DER SINNESORGANE. November, 1905, Bd. 40, Heft 4. *Ueber das Verstehen von Worten und Sätzen* (pp. 225–251): CLIFTON O. TAYLOR. – By observing the introspection of a number of subjects in the comprehension of various texts and in the solution of problems, the following conclusions are reached: The comprehension of sentences of concrete content may be aided by the development of congruent imagery. These auxiliary images become less frequent as the matters treated of in the text are more familiar. The comprehension of sentences of abstract content is not facilitated by such imagery, but rather hindered. Pauses not occupied by special experiences appear necessary to comprehension. The influence of context may aid in comprehension without the appearance in consciousness of any special contextual experience. *Die Orientierung der Brieftauben* (pp. 252–279): G. H. SCHNEIDER. – The problem to which this study was limited was whether the carrier-pigeon possesses an innate sense of direction, or whether it is guided by the eye, and in this case what factors in topography and the like are significant. The